Stream Chemistry and Ecology

Surface-water assessments included water, bed sediment, and fish tissue chemistry; fish, invertebrate, and algal communities; and physical habitat. Sites were chosen across the study area for spatial coverage and distribution in the major aquatic ecological settings within the Allegheny and Monongahela River Basins (fig. 26).

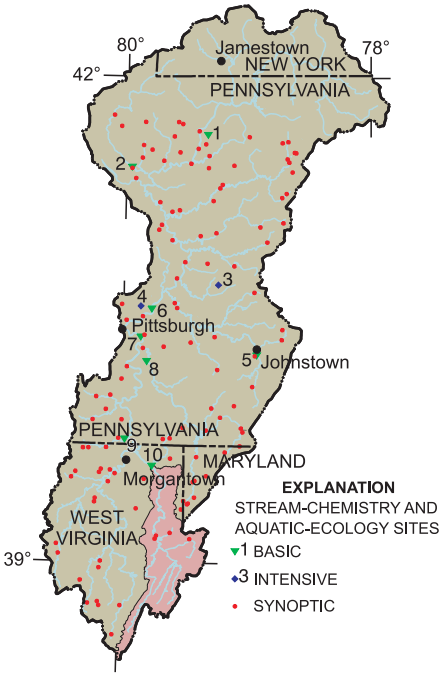


Figure 26. In addition to intensive water-quality sampling at a few sites, one-time sampling at many sites across the study area provided data related to specific land uses. The Cheat River Basin (shaded pink) was similarly sampled.

Basic and intensive sites were sampled monthly for chemistry and annually for ecological condition. One urban site and one agricultural site also were intensively sampled during storms to assess the influence of storm runoff on stream contaminant concentrations. Eighty-nine additional synoptic sites were sampled once to assess the influence of coal mining on water quality across the study area.

Ground-Water Chemistry

Two reconnaissance-type studies were done. The first focused on the fractured-rock aquifers of the coal-bearing Pittsburgh Series rocks of middle and late Pennsylvanian age. The second was set in the coarse- and fine-grained glaciofluvial deposits of the valley-fill aquifers in the northern area of the Allegheny River Basin (fig. 27).

An additional study that focused on mining land use involved sampling of wells that drew water from the fractured-rock aquifers and that were near surface coal mines where mining and reclamation efforts have been completed. The quality of these samples was compared to that of water from 15 wells sampled in unmined areas of the same aquifers.

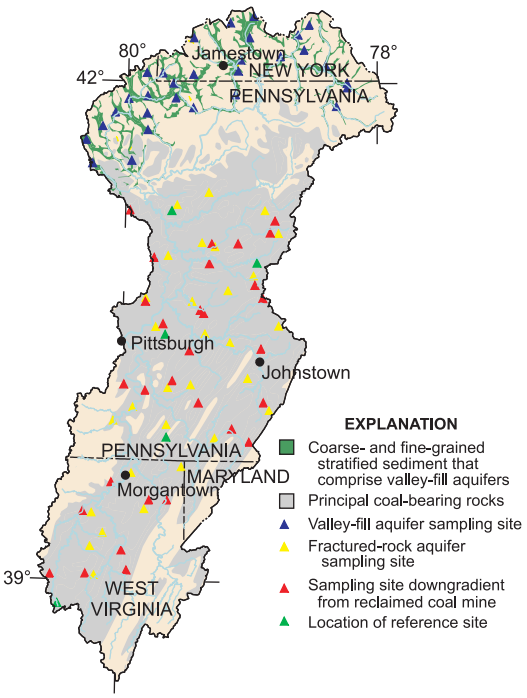


Figure 27. Ground water was sampled from two major aquifer systems, valley-fill aquifers of the northern Allegheny River Basin, and fractured-rock aquifers in the Pittsburgh Series rocks that contain the largest quantities of commercially minable bituminous coal in the ALMN.

Site number (fig. 26)	Site name	Site type	Basin area (square miles)	Site number (fig. 26)	Site name	Site type	Basin area (square miles)
1	East Hickory Creek near Queen, Pa.	Forested	20.3	6	Allegheny River at New Kensington, Pa.	Mixed	11,500
2	French Creek at Utica, Pa.	Mixed	1,028	7	Monongahela River at Braddock, Pa.	Mixed	7,337
3	South Branch Plum Creek at Five Points, Pa.	Agriculture	33.3	8	Youghiogheny River at Sutersville, Pa.	Mixed	1,715
4	Deer Creek near Dorseyville, Pa.	Urban	27.0	9	Dunkard Creek at Shannopin, Pa.	Mining	4,440
5	Stonycreek River at Ferndale, Pa.	Mining	451	10	Cheat River near Mt. Nebo, W. Va.	Mixed	1,132

SUMMARY OF DATA COLLECTION IN THE ALLEGHENY AND MONONGAHELA RIVER BASINS, 1996–98

Study component	What data were collected and why	Types of sites sampled	Number of sites	Sampling frequency and period
Stream Chemistry				
Basic Sites— General water chemistry	Concentrations, seasonal variation, and annual loads. Data included streamflow, field measurements, major ions, nutrients, organic carbon, suspended sediment, trace elements.	Basic Fixed Sites: Representative of common land-use mixes, as well as basin outflow sites.	8	Monthly, April 1996–Sept. 1998
Intensive sites— Pesticides and VOCs	Concentrations and seasonal variations in pesticides. Data included same constituents as above, plus 83 pesticides (dissolved) and 87 volatile organic compounds (VOCs) (only 1 site).	Basic Fixed Sites with intensive urban or agricultural land use.	2	1997, 1998
Contaminants in bed sediments	Occurrence and distribution of contaminants in bed sediment. Data include trace elements, organochlorine compounds, and volatile organic compounds.	Depositional zones of most stream sites sampled in other components of study.	19	Monthly and more frequently
Contaminants in fish tissue	Occurrence and distribution of contaminants in biota. Data included total PCBs, 30 organochlorine pesticides in whole fish, and 24 trace elements in fish livers.	Most stream sites sampled in other components of study where tissue could be collected.	17	Fish Tissue: Summer 1996 and Summer 1997 (Duplicate taxa at two sites)
Stream Ecology				
Ecological assessments	Macroinvertebrates (benthic invertebrates), fish, algae, aquatic and riparian habitat.	Basic Fixed Sites. Intensive Sites.	8 2	1996–97 (10 sites), 1998 (6 sites) One 3-reach site 1996 and 1997
Synoptic studies	Unmined basin to compare to mined basins. The same data were collected at Basic Sites.	Synoptic Site.	1	Once in 1997
Ground-Water Chemistry				
Aquifer survey— Pittsburgh Series fractured rock	Assess quality across aquifer extent. Data include field measurements, major ions, trace metals, nutrients, Pesticides, VOCs, radon, dissolved organic carbon (DOC).	Existing domestic wells chosen with a statistically random selection process. Well depth range 30 to 250 feet.	30	Once in 1996 (July–August)
Aquifer survey— Glaciofluvial deposits of the valley-fill aquifers	Assess quality across aquifer extent. Data include field measurements, major ions, nutrients, pesticides, VOCs, radon, dissolved organic carbon (DOC).	Existing domestic wells chosen with a statistically random selection process. Well depth range 30 to 250 feet.	30	Once in 1996 (September–October)
Land-use effects— Surface coal mining	Compare ground-water quality near reclaimed surface mines to that in unmined areas. Data include major ions, trace metals, nutrients, VOCs, radon, trace elements, dissolved organic carbon (DOC), chlorofluorocarbons (CFCs).	Existing domestic wells chosen with a statistically random selection process. Well depth range 30 to 250 feet. (Data from 10 fractured-rock sampling sites were re-used as reference data in the Land-use effects study.)	45	Once in 1997 (August–October)
Special Studies				
Low-flow synoptic survey of streams in the Appalachian coal fields	To assess quality of surface water relative to type and age of coal mining in the basins. Standard: Mine-drainage indicators, field measurements. Intensive: same as standard sites, plus: major ions, trace elements, macroinvertebrates, aquatic habitat.	Standard Site network. Intensive Site network.	89 32	Standard sites: Once in summer 1998 Intensive sites: Once in summer 1998

GLOSSARY

Aquifer—A water-bearing layer of soil, sand, gravel, or rock that will yield usable quantities of water to a well.

Background concentration— A concentration of a substance in a particular environment that is indicative of minimal influence by human (anthropogenic) sources.

Bed sediment— The material that temporarily is stationary in the bottom of a stream or other watercourse.

DDT—Dichloro-diphenyl-trichloroethane. An organochlorine insecticide no longer registered for use in the United States.

Ground water—In general, any water that exists beneath the land surface, but more commonly applied to water in fully saturated soils and geologic formations.

Herbicide—A chemical or other agent applied for the purpose of killing undesirable plants. See also Pesticide.

Human health advisory—Guidance provided by U.S. Environmental Protection Agency, State agencies, or scientific organizations, in the absence of regulatory limits, to describe acceptable contaminant levels in drinking water or edible fish.

Insecticide—A substance or mixture of substances intended to destroy or repel insects. See also Pesticides.

Maximum contaminant level (MCL)—Maximum permissible level of a contaminant in water that is delivered to any user of a public water system. MCLs are enforceable standards established by the U.S. Environmental Protection Agency.

Method detection limit—The minimum concentration of a substance that can be accurately identified and measured with present laboratory technologies.

Micrograms per liter (µg/L)—A unit expressing the concentration of constituents in solution as weight (micrograms) of solute per unit volume (liter) of water; equivalent to one part per billion in most stream water and ground water. One thousand micrograms per liter equals 1 milligram per liter.

Milligrams per liter (mg/L)—A unit expressing the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water; equivalent to one part per million in most stream water and ground water. One thousand micorgrams per liter equals 1 mg/L.

Organochlorine compound—Synthetic organic compounds containing chlorine. As generally used, term refers to compounds containing mostly or exclusively carbon, hydrogen, and chlorine. Examples include organochlorine insecticides, polychlorinated biphenyls, and some solvents containing chlorine.

Pesticide—A chemical applied to crops, rights of way, lawns, or residences to control weeds, insects, fungi, nematodes, rodents, or other "pests."

pH—The logarithm of the reciprocal of the hydrogen ion concentration (activity) of a solution; a measure of the acidity (pH less than 7) or alkalinity (pH greater than 7) of a solution; a pH of 7 is neutral.

Polychlorinated biphenyls (PCBs)—A mixture of chlorinated derivatives of biphenyl, marketed under the trade name Aroclor with a number designating the chlorine content (such as Aroclor 1260). PCBs were used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Further sale for new use was banned by law in 1979.

Secondary maximum contaminant level (SMCL)—The maximum contamination level in public water systems that, in the judgment of the U.S. Environmental Protection Agency (USEPA), is required to protect the public welfare. SMCLs are secondary (nonenforceable) drinking water regulations established by the USEPA for contaminants that may adversely affect the odor or appearance of such water.

Semivolatile organic compound (SVOC)—Operationally defined as a group of synthetic organic compounds that are solvent-extractable and can be determined by gas chromatography/mass spectrometry. SVOCs include phenols, phthalates, and polycyclic aromatic hydrocarbons (PAHs).

Suspended sediment—Particles of rock, sand, soil, and organic detritus carried in suspension in the water column, in contrast to sediment that moves on or near the streambed or rests on the bottom of the stream.

Trace element—An element found in only minor amounts (concentrations less than 1.0 milligram per liter) in water or sediment; includes arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Upgradient—Of or pertaining to the place(s) from which ground water originated or traveled through before reaching a given point in an aquifer.

Volatile organic compounds (VOCs)—Organic chemicals that have a high vapor pressure relative to their water solubility. VOCs include components of gasoline, fuel oils, and lubricants, as well as organic solvents, fumigants, some inert ingredients in pesticides, and some byproducts of chlorine disinfection.

Water-quality guidelines—Specific levels of water quality which, if reached, may adversely affect human health or aquatic life. These are nonenforceable guidelines issued by a governmental agency or other institution.

Water-quality standards—State-adopted and U.S. Environmental Protection Agency-approved ambient standards for water bodies. Standards include the use of the water body and the water-quality criteria that must be met to protect the designated use or uses.

Yield—The mass of material or constituent transported by a river in a specified period of time divided by the drainage area of the river basin.

Becher, A.E., 1999, Groundwater, *in* Shultz, C.H., ed., The geology of Pennsylvania: Pennsylvania Geological Survey and Pittsburgh Geological Society, 888 p.

Bender, D.A., Zogorski, J.S., Halde, M.J., and Rowe, B.L., 1999, Selection procedure and salient information for volatile organic compounds emphasized in the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 99–182, 32 p.

Biesecker, J.E., and George, J.R., 1966, Stream quality in Appalachia as related to coal-mine drainage, 1965: U.S. Geological Survey Circular 526, 27 p., 1 pl.

Britton, L.J., Anderson, C.L., Goolsby, D.A., and Van Haveren, B.P., eds., 1989, Summary of the USGS and U.S. Bureau of Land Management National Coal Hydrology Program, 1974–84: U.S. Geological Survey Professional Paper 1464, 183 p.

Canadian Council of Ministers of the Environment, 1995, Protocol for the derivation of Canadian sediment quality guidelines for the protection of aquatic life: Winnipeg, Manitoba, Task Group on Water Quality Guidelines report CCME EPC–98E, 38 p.

Capel, P.D., Spexet, A.H., and Larson, S.J., 1999, Occurrence and behavior of the herbicide prometon in the hydrologic system: Environmental Science and Technology, v. 33, no. 5, p. 674–680.

Coll, M.B., Jr., and Siwicki, R.W., 1997, Water resources data, Pennsylvania, water year 1997, v. 3, Ohio River and St. Lawrence River Basins: U.S. Geological Survey Water-Data Report PA–97–3, 339 p.

Cooper, E.L., 1983, Fishes of Pennsylvania and the Northeastern United States: University Park, Pa., Pennsylvania State Press, 243 p.

Eychaner, J.H., 1999, Progress of environmental studies in coal mining areas of western Pennsylvania and central West Virginia, *in* Twentieth Annual West Virginia Surface Mine Drainage Task Force Symposium, 1999, Proceedings: Morgantown, W. Va., 6 p.

Ferguson, J.F., and Gavis, J., 1972, A review of the arsenic cycle in natural waters: Water Research, v. 6, p. 1259–1274.

Finni, G.R., 1988, The benthic macroinvertebrates of the Monongahela River near Pittsburgh, Pennsylvania—Final report to the U.S. Fish and Wildlife Service: Mewton Corner, Mass., 48 p.

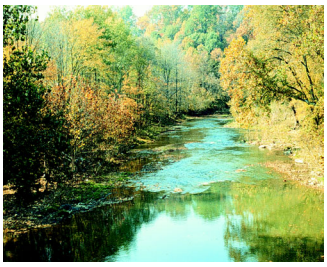
Gilliom, R.J., Alley, W.M., and Gurtz, M.E., 1995, Design of the National Water-Quality Assessment Program—Occurrence and distribution of water-quality conditions: U.S. Geological Survey Circular 1112, 33 p.

More than two-thirds of the study area is hemlock and hardwood forest.

Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, 263 p.

Letterman, R.D., and Mitsch, W.J., 1978, Impact of mine drainage on a mountain stream in Pennsylvania: Environmental Pollution, v. 17, p. 53–73.

Lindsey, B.D., and Bickford, T.M., 1999, Hydrogeologic framework and sampling design for an assessment of agricultural pesticides in ground water in Pennsylvania: U.S. Geological Survey Water-Resources Investigations Report 99–4076, 44 p.



Diverse aquatic communities can be found in western tributaries.

Lopes, T.J., and Bender, D.A., 1998, Nonpoint sources of volatile organic compounds in urban areas—Relative importance of land surfaces and air: Environmental Pollution, v. 101, p. 221–230.

Masters, L.L., Flack, S.R., and Stein, B.A., eds., 1998, Rivers of life—Critical watersheds for protecting biodiversity: Arlington, Va., The Nature Conservancy, 71 p.

McAuley, S.D., 1995, National Water Quality Assessment Program—The Allegheny-Monongahela River Basin: U.S. Geological Survey Fact Sheet 137–95, 2 p.

Newell, A.J., Johnson, D.W., and Allen, L.K., 1987, Niagara River biota contamination project—Fish flesh criteria for piscivorous wildlife: New York State Department of Environmental Conservation, Division of Fish and Wildlife, Bureau of Environmental Protection Technical Report 87–3, 182 p.

Ohio River Basin Commission, 1980, Allegheny River Basin—Regional water and land resources plan and environmental impact statement: Cincinnati, Ohio, Ohio River Basin Commission, 178 p. plus appendixes.

Omernick, J.M., 1987, Aquatic ecoregions of the conterminous United States: accessed January 17, 2001, at URL http://water.usgs.gov/lookup/getcover?ecoregion/.

Ortmann, A.E., 1909, The destruction of the fresh-water fauna in western Pennsylvania: Proceedings of the American Philosophical Society, v. 5, p. 91–110.

Pennsylvania Department of Conservation and Natural Resources, 2000, accessed August 17, 2000, at URL http://www.dcnr.state.pa.us/rivers/smap.htm.

Pennsylvania Department of Environmental Protection, 1996, Commonwealth of Pennsylvania Water Quality Assessment 305(b) Report: Pennsylvania Department of Environmental Protection, 94 p.

_____1999, The science of acid mine drainage and passive treatment: Bureau of Abandoned Mine Reclamation, 10 p.

Pennsylvania Department of Environmental Resources, 1984, Pennsylvania Code Title 25, Environmental resources—Water quality standards: Harrisburg, Pa., Bureau of Water Quality Assessment, chap. 93, 212 p.

Pennsylvania Fish and Boat Commission, 1999, accessed September 12, 2000, at URL http://www.state.pa.us/PA_Exec/Fish_Boat/fishadvi.htm.

Puente, Celso, and Atkins, J.T., 1989, Simulation of rainfall-runoff response in mined and unmined watersheds in coal area of West Virginia: U.S. Geological Survey Water-Supply Paper 2298, 48 p.

Risser, D.W., and Madden, T.M., Jr., 1994, Evaluation of methods for delineating areas that contribute water to wells completed in valley-fill aquifers in Pennsylvania: U.S. Geological Survey Open-File Report 92–635, 82 p.

Rose, A.W., and Cravotta, C.A., III, 1998, Geochemistry of coal mine drainage, *in* Coal mine drainage prediction and pollution prevention in Pennsylvania: Pennsylvania Department of Environmental Protection, 371 p.

Urban areas generally are within river valleys.

Sams, J.I., and Beer, K.M., 2000, Effects of coal-mine drainage on stream water quality in the Allegheny and Monongahela River Basins—Sulfate transport and trends: U.S. Geological Survey Water-Resources Investigations Report 99–4208, 17 p.

Tully, John, 1996, Coal fields of the conterminous United States: U.S. Geological Survey Open-File Report 96–92, 1 sheet, scale 1:5,000,000.

U.S. Army Corps of Engineers, 1976, Monongahela River navigation projects, annual water quality report, 1976: Pittsburgh, Pa., 106 p.

U.S. Environmental Protection Agency, 1999a, Health effects from exposure to high levels of sulfate in drinking water study: U.S. Environmental Protection Agency, Office of Water and Ground Water, EPA–815–R–99–001, 25 p.

_____1999b, Proposed radon in drinking water rule: U.S. Environmental Protection Agency report EPA 815–F–99–006, accessed July 14, 2000, at URL http://www.epa.gov/OGWDW/radon/fact.html.

_____1996, The National Sediment Quality Survey—A report to Congress on the extent and severity of sediment contamination in surface waters of the United States: U.S. Environmental Protection Agency, Office of Science and Technology, Draft Report EPA 823–D–96–002.

U.S. Geological Survey, 1999a, The quality of our Nation's waters—Nutrients and pesticides: U.S. Geological Survey Circular 1225, 82 p.

_____1999b, Pesticides analyzed in NAWQA samples—Use, chemical analyses, and water-quality criteria: accessed December 28, 2000, at URL http://cd.water.usgs.gov/pnsp/anstrat/index.htm/.

Welch, A.H., Lico, M.S., and Hughes, J.L., 1988, Arsenic in ground water of the western United States: Ground Water, v. 26, no. 3, p. 333–347.

Farm fields, intermixed with forest, follow hill contours.

West Virginia Department of Environmental Protection, 1998, West Virginia's Water Quality Assessment 305(b) Report: West Virginia Department of Environmental Protection, 142 p.

Williams, D.R., and Clark, M.E., 2001, Nutrients and organic compounds in Deer Creek and South Branch Plum Creek in southwestern Pennsylvania, April 1996 through September 1998: U.S. Geological Survey Water-Resources Investigations Report 00–4061.

Williams, D.R., Clark, M.E., and Brown, J.B., 1999, Stream water quality in coal mined areas of the Lower Cheat River Basin, West Virginia and Pennsylvania, during low-flow conditions, July 1997: U.S. Geological Survey Water-Resources Investigations Report 98–4258, 8 p.

Williams, D.R., Sams, J.I., III, and Mulkerrin, M.E., 1996, Effects of coal-mine discharges on the quality of the Stonycreek River and its tributaries, Somerset and Cambria Counties, Pennsylvania: U.S. Geological Survey Water-Resources Investigations Report 96–4133, 95 p.

Coal mining is a difficult land use to quantify but is one that can significantly alter water quality.

APPENDIX—WATER-QUALITY DATA FROM THE ALLEGHENY AND MONONGAHELA RIVER BASINS IN A NATIONAL CONTEXT

For a complete view of Allegheny and Monongahela River Basins data and for additional information about specific benchmarks used, visit our Web site at http://water.usgs.gov/nawqa/. Also visit the NAWQA Data Warehouse for access to NAWQA data sets at http://infotrek.er.usgs.gov/wdbctx/nawqa/nawqa.home.

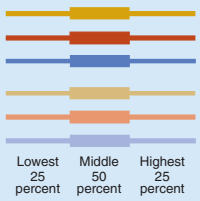
This appendix is a summary of chemical concentrations and biological indicators assessed in the Allegheny and Monongahela River Basins. Selected results for this Study Unit are graphically compared to results from as many as 36 NAWQA Study Units investigated from 1991 to 1998 and to national water-quality benchmarks for human health, aquatic life, or fish-eating wildlife. The chemical and biological indicators shown were selected on the basis of frequent detection, detection at concentrations above a national benchmark, or regulatory or scientific importance. The graphs illustrate how conditions associated with each land use sampled in the Allegheny and Monongahela River Basins compare to results from across the Nation, and how conditions compare among the several land uses. Graphs for chemicals show only detected concentrations and, thus, care must be taken to evaluate detection frequencies in addition to concentrations when comparing study-unit and national results. For example, metolachlor concentrations in the Allegheny and Monongahela River Basins urban stream sampled were similar to the national distribution, but the detection frequency was much higher (96 percent compared to 64 percent).

CHEMICALS IN WATER

Concentrations and detection frequencies, Allegheny and Monongahela River Basins, 1996–98—Detection sensitivity varies among chemicals and, thus, frequencies are not directly comparable among chemicals

- ◆ Detected concentration in Study Unit
- 66 38 Frequencies of detection, in percent. Detection frequencies were not censored at any common reporting limit. The left-hand column is the study-unit frequency and the right-hand column is the national frequency
- -- Not measured or sample size less than two
- 12 Study-unit sample size. For ground water, the number of samples is equal to the number of wells sampled

National ranges of detected concentrations, by land use, in 36 NAWQA Study Units, 1991–98—Ranges include only samples in which a chemical was detected

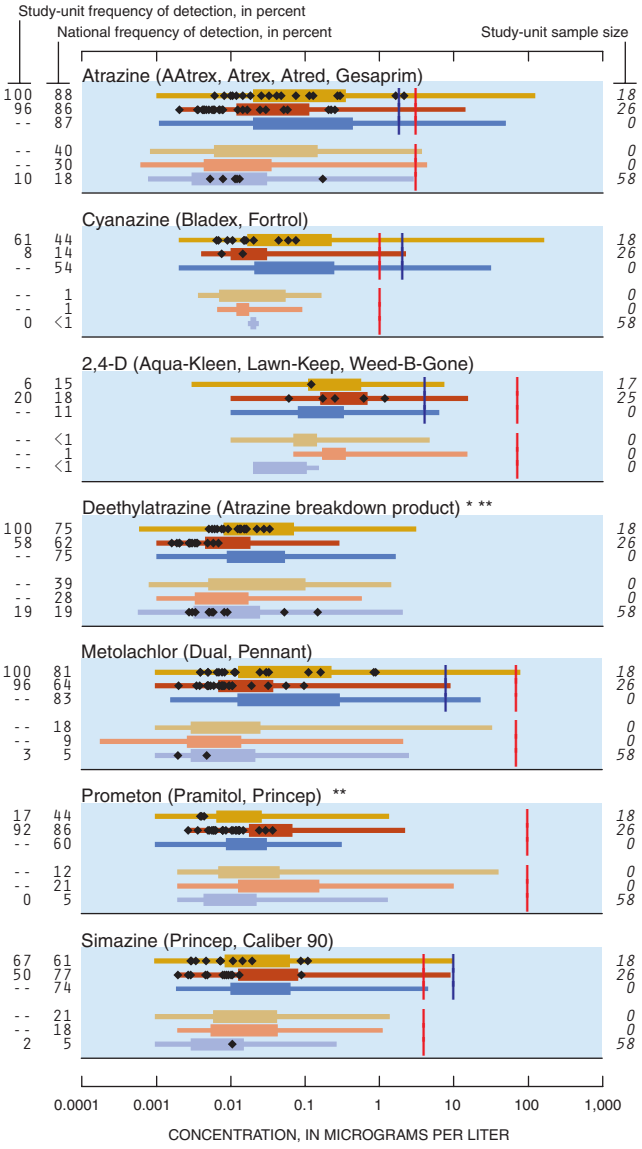


National water-quality benchmarks

National benchmarks include standards and guidelines related to drinking-water quality, criteria for protecting the health of aquatic life, and a goal for preventing stream eutrophication due to phosphorus. Sources include the U.S. Environmental Protection Agency and the Canadian Council of Ministers of the Environment

- | Drinking-water quality (applies to ground water and surface water)
- | Protection of aquatic life (applies to surface water only)
- | Prevention of eutrophication in streams not flowing directly into lakes or impoundments
- * No benchmark for drinking-water quality
- ** No benchmark for protection of aquatic life

Pesticides in water—Herbicides

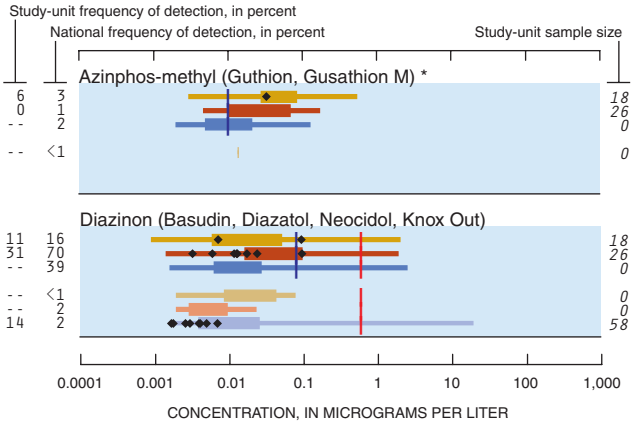


Other herbicides detected

Acetochlor (Harness Plus, Surpass) * **
Acifluorfen (Blazer, Tackle 2S) **
Alachlor (Lasso, Bronco, Lariat, Bullet) **
Bentazon (Basagran, Bentazone) **
Bromoxynil (Buctril, Brominal) *
DCPA (Dacthal, chlorthal-dimethyl) * **
Dicamba (Banvel, Dianat, Scotts Proturf)
Dichlorprop (2,4-DP, Seritox 50, Lentemul) * **
Diuron (Crisuron, Karmex, Diurex) **
EPTC (Eptam, Farmarox, Alirox) * **
Fenuron (Fenulon, Fenidim) * **
MCPA (Rhomene, Rhonox, Chiptox)
Metribuzin (Lexone, Sencor)
Napropamide (Devrinol) * **
Neburon (Neburea, Neburyl, Noruben) * **
Pendimethalin (Pre-M, Prowl, Stomp) * **
Propachlor (Ramrod, Satecid) **
Tebuthiuron (Spike, Tebusan)
Terbacil (Sinbar) **

Herbicides not detected
Benfluralin (Balan, Benefin, Bonalan) * **
Bromacil (Hyvar X, Urox B, Bromax)
Butylate (Sutan +, Genate Plus, Butilate) **
Chloramben (Amiben, Amilon-WP, Vegiben) **
Clopyralid (Stinger, Lontrel, Transline) * **
2,4-DB (Butyrac, Butoxone, Embutox Plus, Embutone) * **
Dacthal mono-acid (Dacthal breakdown product) * **
2,6-Diethylaniline (Alachlor breakdown product) * **
Dinoseb (Dinosebe)
Ethalfluralin (Sonalan, Curbit) * **
Fluometuron (Flo-Met, Cotoran) **
Linuron (Lorox, Linex, Sarclex, Linurex, Afalon) *
MCPB (Thistrol) * **
Molinate (Ordram) * **
Norflurazon (Evital, Predict, Solicam, Zorial) * **
Oryzalin (Surflan, Dirimal) * **
Pebulate (Tillam, PEBC) * **
Picloram (Grazon, Tordon)
Pronamide (Kerb, Propyzamid) **
Propanil (Stam, Stampede, Wham) * **
Propham (Tuberite) **
2,4,5-T **
2,4,5-TP (Silvex, Fenoprop) **
Thiobencarb (Bolero, Saturn, Benthiocarb) * **
Triallate (Far-Go, Avadex BW, Tri-allate) *
Triclopyr (Garlon, Grandstand, Redeem, Remedy) * **
Trifluralin (Treflan, Gowan, Tri-4, Trific)

Pesticides in water—Insecticides

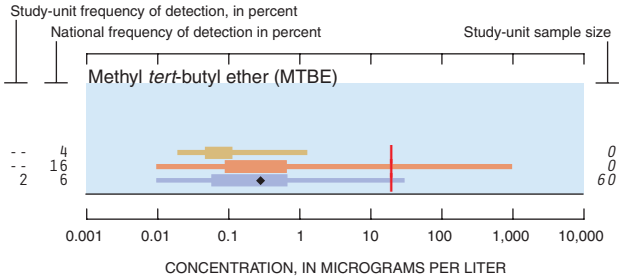


Other insecticides detected
Carbaryl (Carbamine, Denapon, Sevin)
Carbofuran (Furadan, Curaterr, Yaltox)
Chlorpyrifos (Brodan, Dursban, Lorsban)
Fonofos (Dyfonate, Capfos, Cudgel, Tycap) **

Insecticides not detected
Aldicarb (Temik, Ambush, Pounce)
Aldicarb sulfone (Standak, aldoxycarb)
Aldicarb sulfoxide (Aldicarb breakdown product)
p,p'-DDE
Dieldrin (Panoram D-31, Octalox, Compound 497)
Disulfoton (Disyston, Di-Syston) **
Ethoprop (Mocap, Ethoprophos) * **
alpha-HCH (alpha-BHC, alpha-lindane) **
gamma-HCH (Lindane, gamma-BHC)
3-Hydroxycarbofuran (Carbofuran breakdown product) * **
Malathion (Malathion)
Methiocarb (Slug-Geta, Grandslam, Mesurol) * **
Methomyl (Lanox, Lannate, Acinate) **
Methyl parathion (Penncap-M, Folidol-M) **
Oxamyl (Vydate L, Pratt) **
Parathion (Roethyl-P, Alkron, Panthion, Phoskil) *
cis-Permethrin (Ambush, Astro, Pounce) * **
Phorate (Thimet, Granutox, Geomet, Rampart) * **
Propargite (Comite, Omite, Ornamite) * **
Propoxur (Baygon, Blattanex, Unden, Proprotox) * **
Terbufos (Contraven, Counter, Pilarfox) **

Volatile organic compounds (VOCs) in ground water

These graphs represent data from 16 Study Units, sampled from 1996 to 1998

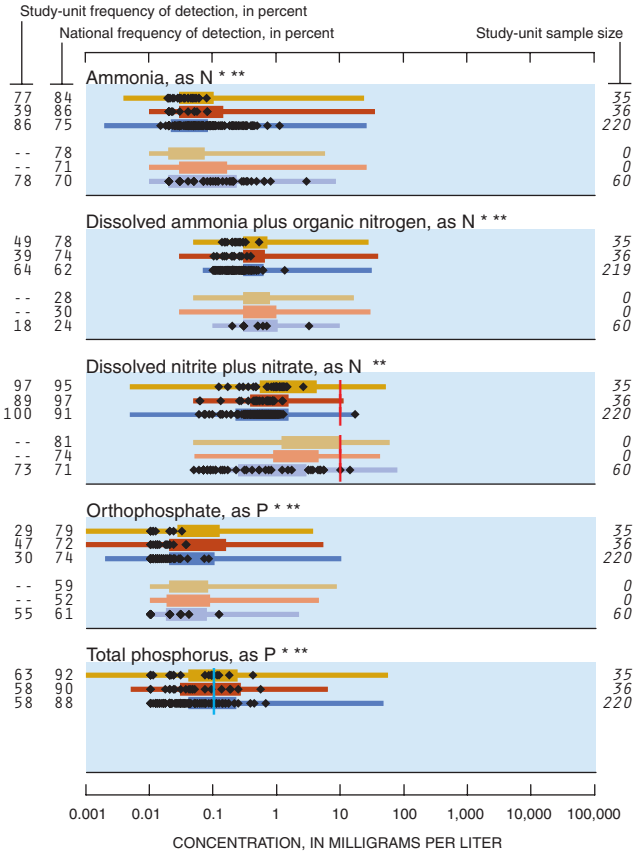


Other VOCs detected
Benzene
Bromodichloromethane (Dichlorobromomethane)
2-Butanone (Methyl ethyl ketone (MEK)) *
sec-Butylbenzene *
Carbon disulfide *
Chlorobenzene (Monochlorobenzene)
Chlorodibromomethane (Dibromochloromethane)
Chloromethane (Methyl chloride)
Dichlorodifluoromethane (CFC 12, Freon 12)
cis-1,2-Dichloroethene ((Z)-1,2-Dichloroethene)
Dichloromethane (Methylene chloride)
1,2-Dimethylbenzene (*o*-Xylene)
1,4-Epoxy butane (Tetrahydrofuran, Diethylene oxide) *
Ethenylbenzene (Styrene)
Ethylbenzene (Phenylethane)
Iodomethane (Methyl iodide) *
Tetrachloroethene (Perchloroethene)
Tetrachloromethane (Carbon tetrachloride)
Tribromomethane (Bromoform)
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) *
1,1,1-Trichloroethane (Methylchloroform)
Trichloroethene (TCE)
Trichloromethane (Chloroform)
1,2,3-Trimethylbenzene (Hemimellitene) *
1,2,4-Trimethylbenzene (Pseudocumene) *

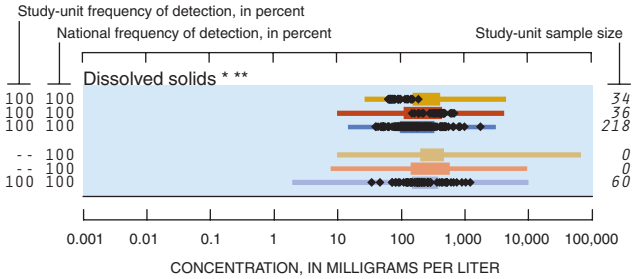
VOCs not detected
tert-Amylmethylether (*tert*-amyl methyl ether (TAME)) *
Bromobenzene (Phenyl bromide) *
Bromochloromethane (Methylene chlorobromide)
Bromoethene (Vinyl bromide) *
Bromomethane (Methyl bromide)
n-Butylbenzene (1-Phenylbutane) *
tert-Butylbenzene *
3-Chloro-1-propene (3-Chloropropene) *
1-Chloro-2-methylbenzene (*o*-Chlorotoluene)
1-Chloro-4-methylbenzene (*p*-Chlorotoluene)
Chloroethane (Ethyl chloride) *
Chloroethene (Vinyl chloride)
1,2-Dibromo-3-chloropropane (DBCP, Nemagon)
1,2-Dibromoethane (Ethylene dibromide, EDB)
Dibromomethane (Methylene dibromide) *
trans-1,4-Dichloro-2-butene ((Z)-1,4-Dichloro-2-butene) *
1,2-Dichlorobenzene (*o*-Dichlorobenzene)
1,3-Dichlorobenzene (*m*-Dichlorobenzene)
1,4-Dichlorobenzene (*p*-Dichlorobenzene)
1,2-Dichloroethane (Ethylene dichloride)
1,1-Dichloroethane (Ethylidene dichloride) *
1,1-Dichloroethene (Vinylidene chloride)
trans-1,2-Dichloroethene ((E)-1,2-Dichlorothene)
1,2-Dichloropropane (Propylene dichloride)
2,2-Dichloropropane *
1,3-Dichloropropane (Trimethylene dichloride) *
trans-1,3-Dichloropropene ((E)-1,3-Dichloropropene)
cis-1,3-Dichloropropene ((Z)-1,3-Dichloropropene)
1,1-Dichloropropene *
Diethyl ether (Ethyl ether) *
Diisopropyl ether (Diisopropylether (DIPE)) *
1,3 & 1,4-Dimethylbenzene (*m*-&*p*-Xylene)
Ethyl methacrylate *
Ethyl *tert*-butyl ether (Ethyl-*t*-butyl ether (ETBE)) *

1-Ethyl-2-methylbenzene (2-Ethyltoluene) *
Hexachlorobutadiene
1,1,1,2,2,2-Hexachloroethane (Hexachloroethane)
2-Hexanone (Methyl butyl ketone (MBK)) *
Isopropylbenzene (Cumene) *
p-Isopropyltoluene (*p*-Cymene) *
Methyl acrylonitrile *
Methyl-2-methacrylate (Methyl methacrylate) *
4-Methyl-2-pentanone (Methyl isobutyl ketone (MIBK)) *
Methyl-2-propenoate (Methyl acrylate) *
Methylbenzene (Toluene)
Naphthalene
2-Propanone (Acetone) *
2-Propenenitrile (Acrylonitrile)
n-Propylbenzene (Isocumene) *
1,1,2,2-Tetrachloroethane *
1,1,1,2-Tetrachloroethane
1,2,3,4-Tetramethylbenzene (Prehnitene) *
1,2,3,5-Tetramethylbenzene (Isodurene) *
1,2,4-Trichlorobenzene
1,2,3-Trichlorobenzene *
1,1,2-Trichloroethane (Vinyl trichloride)
Trichlorofluoromethane (CFC 11, Freon 11)
1,2,3-Trichloropropane (Allyl trichloride)
1,3,5-Trimethylbenzene (Mesitylene) *

Nutrients in water

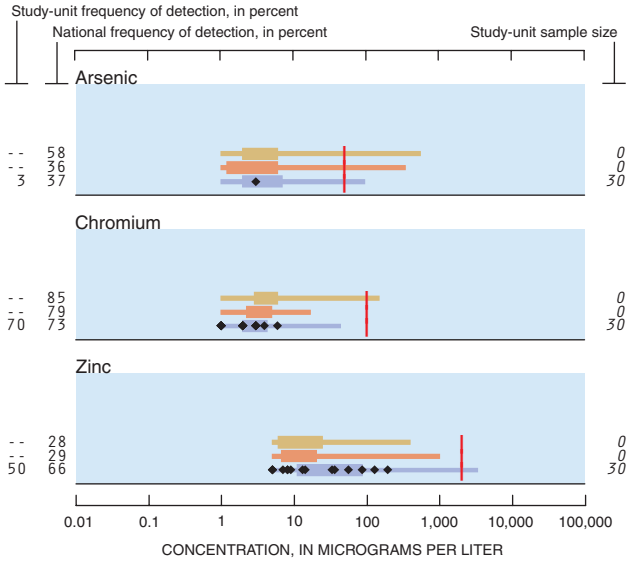


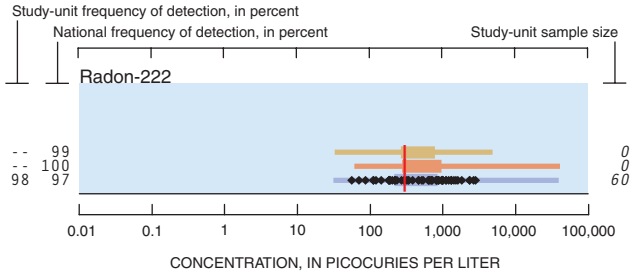
Dissolved solids in water



Trace elements in ground water

Trace-element data are only from the fractured rock aquifer survey; no trace element data were collected from the glacial sediments aquifer





Other trace elements detected
Lead
Selenium

Trace elements not detected
Cadmium
Uranium

CHEMICALS IN FISH TISSUE AND BED SEDIMENT

Concentrations and detection frequencies, Allegheny and Monongahela River Basins, 1996–98—Detection sensitivity varies among chemicals and, thus, frequencies are not directly comparable among chemicals. Study-unit frequencies of detection are based on small sample sizes; the applicable sample size is specified in each graph

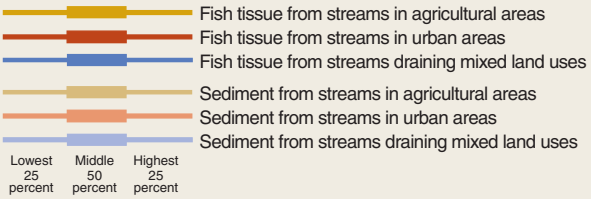
◆ Detected concentration in Study Unit

66 38 Frequencies of detection, in percent. Detection frequencies were not censored at any common reporting limit. The left-hand column is the study-unit frequency and the right-hand column is the national frequency

-- Not measured or sample size less than two

12 Study-unit sample size

National ranges of concentrations detected, by land use, in 36 NAWQA Study Units, 1991–98—Ranges include only samples in which a chemical was detected



National benchmarks for fish tissue and bed sediment

National benchmarks include standards and guidelines related to criteria for protection of the health of fish-eating wildlife and aquatic organisms. Sources include the U.S. Environmental Protection Agency, other Federal and State agencies, and the Canadian Council of Ministers of the Environment

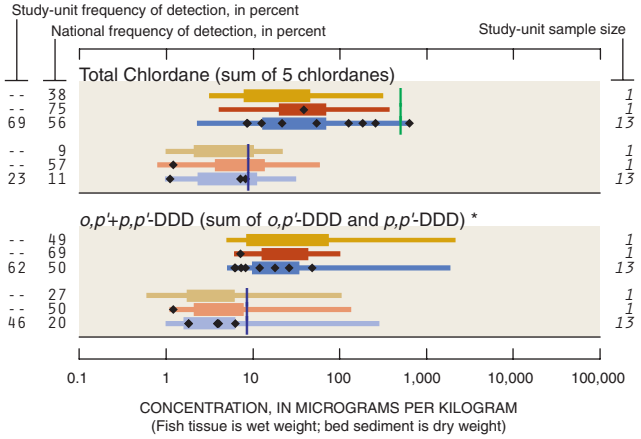
| Protection of fish-eating wildlife (applies to fish tissue)

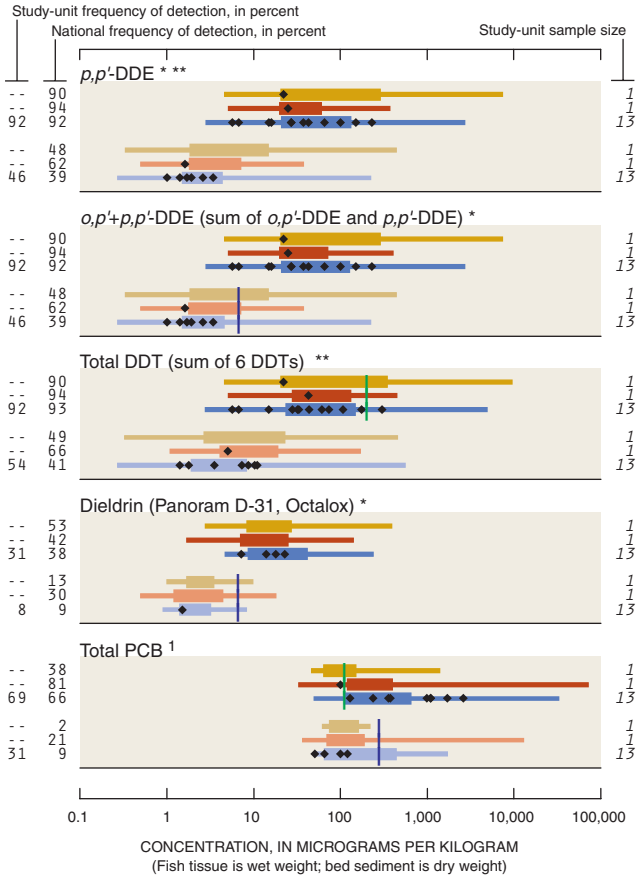
| Protection of aquatic life (applies to bed sediment)

* No benchmark for protection of fish-eating wildlife

** No benchmark for protection of aquatic life

Organochlorines in fish tissue (whole body) and bed sediment





[1] The national detection frequencies for total PCB in sediment are biased low because about 30 percent of samples nationally had elevated detection levels compared to this Study Unit. See http://water.usgs.gov/nawqa/ for additional information.

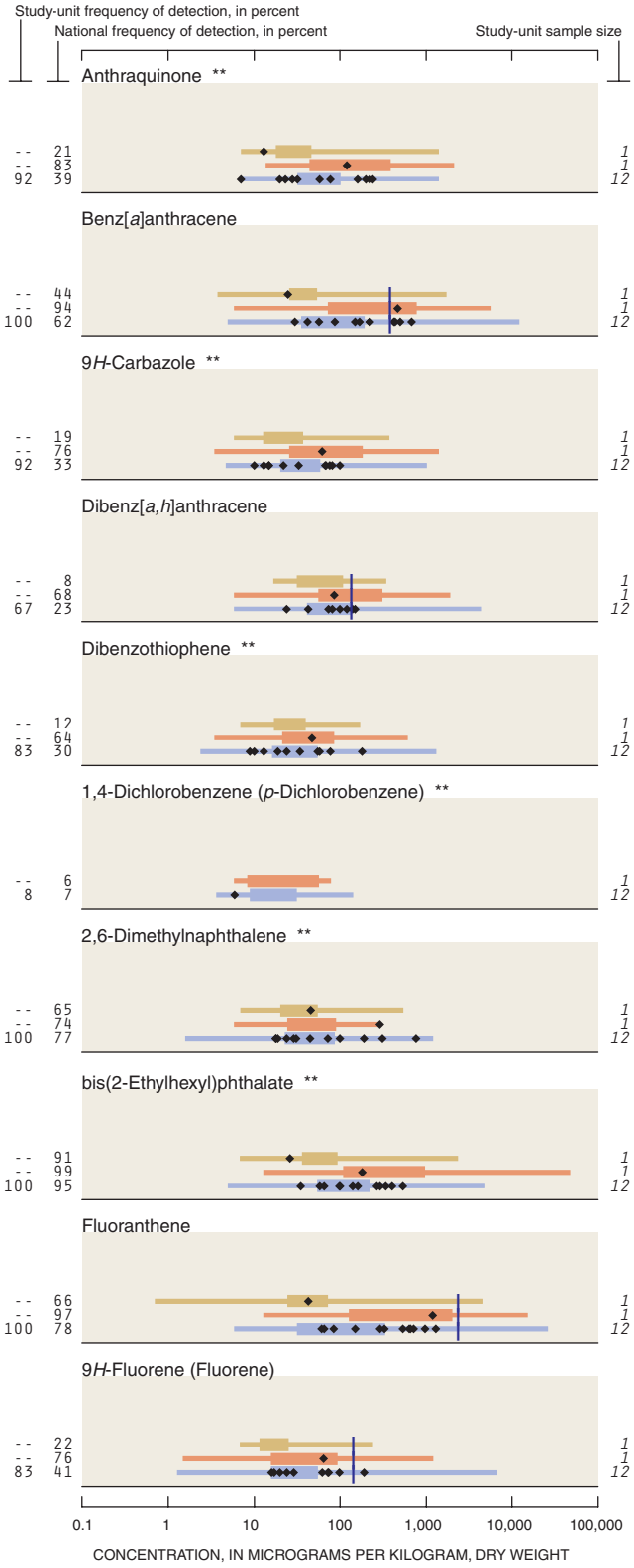
Other organochlorines detected

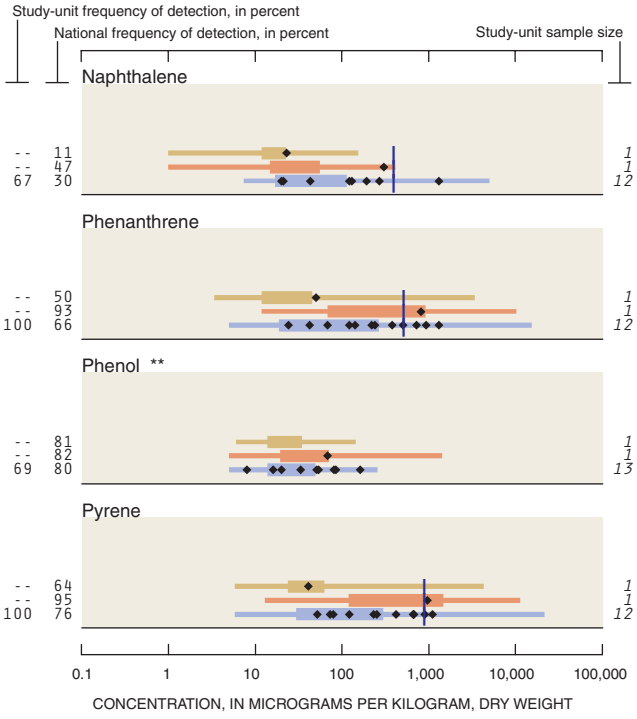
o,p'+*p,p'*-DDT (sum of *o,p'*-DDT and *p,p'*-DDT) *
Dieldrin+aldrin (sum of dieldrin and aldrin) **
Hexachlorobenzene (HCB) **
o,p'-Methoxychlor * **
Pentachloroanisole (PCA) * **
cis-Permethrin (Ambush, Astro, Pounce) * **
trans-Permethrin (Ambush, Astro, Pounce) * **

Organochlorines not detected

Chloroneb (Chloronebe, Demosan) * **
DCPA (Dacthal, chlorthal-dimethyl) * **
Endosulfan I (alpha-Endosulfan, Thiodan) * **
Endrin (Endrine)
gamma-HCH (Lindane, gamma-BHC, Gammexane) *
Total-HCH (sum of alpha-HCH, beta-HCH, gamma-HCH, and delta-HCH) **
Heptachlor epoxide (Heptachlor breakdown product) *
Heptachlor+heptachlor epoxide (sum of heptachlor and heptachlor epoxide) **
Isodrin (Isodrine, Compound 711) * **
p,p'-Methoxychlor (Marlate, methoxychlore) * **
Mirex (Dechlorane) **
Toxaphene (Camphechlor, Hercules 3956) * **

Semivolatile organic compounds (SVOCs) in bed sediment





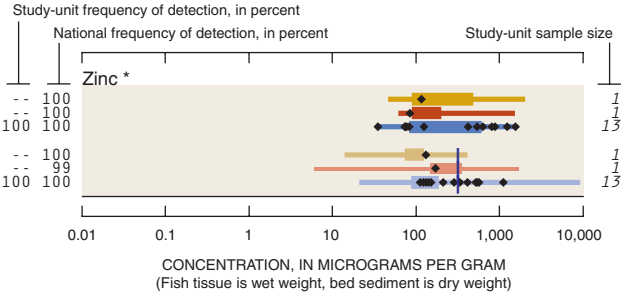
Other SVOCs detected

Acenaphthene
Acenaphthylene
Acridine **
C8-Alkylphenol **
Anthracene
Benzo[*a*]pyrene
Benzo[*b*]fluoranthene **
Benzo[*ghi*]perylene **
Benzo[*k*]fluoranthene **
Butylbenzylphthalate **
Chrysene
p-Cresol **
Di-*n*-butylphthalate **
Di-*n*-octylphthalate **
Diethylphthalate **
1,2-Dimethylnaphthalene **
1,6-Dimethylnaphthalene **
3,5-Dimethylphenol **
Dimethylphthalate **
2-Ethylnaphthalene **
Indeno[1,2,3-*cd*]pyrene **
Isoquinoline **
1-Methyl-9*H*-fluorene **
2-Methylanthracene **
4,5-Methylenephenanthrene **
1-Methylphenanthrene **
1-Methylpyrene **
Phenanthridine **
Quinoline **
2,3,6-Trimethylnaphthalene **

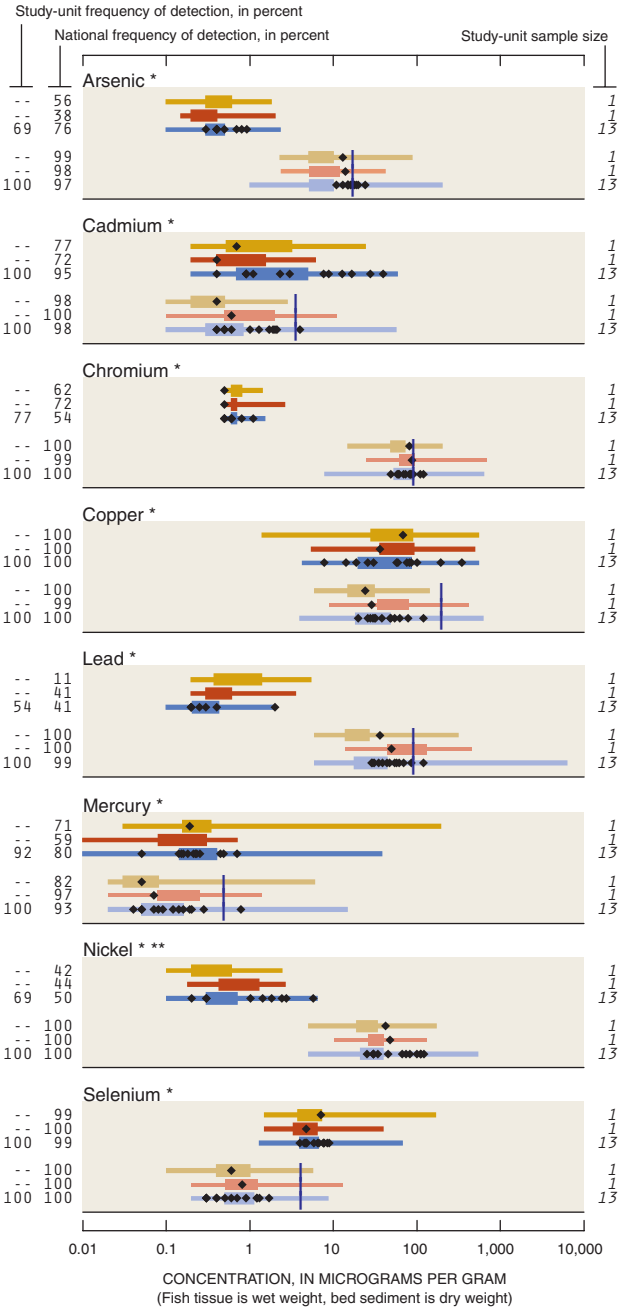
SVOCs not detected

Azobenzene **
Benzo[*c*]cinnoline **
2,2-Biquinoline **
4-Bromophenyl-phenylether **
4-Chloro-3-methylphenol **
bis(2-Chloroethoxy)methane **

2-Chloronaphthalene **
2-Chlorophenol **
4-Chlorophenyl-phenylether **
1,2-Dichlorobenzene (*o*-Dichlorobenzene) **
1,3-Dichlorobenzene (*m*-Dichlorobenzene) **
2,4-Dinitrotoluene **
Isophorone **
Nitrobenzene **
N-Nitrosodi-*n*-propylamine **
N-Nitrosodiphenylamine **
Pentachloronitrobenzene **
1,2,4-Trichlorobenzene **



Trace elements in fish tissue (livers) and bed sediment



BIOLOGICAL INDICATORS

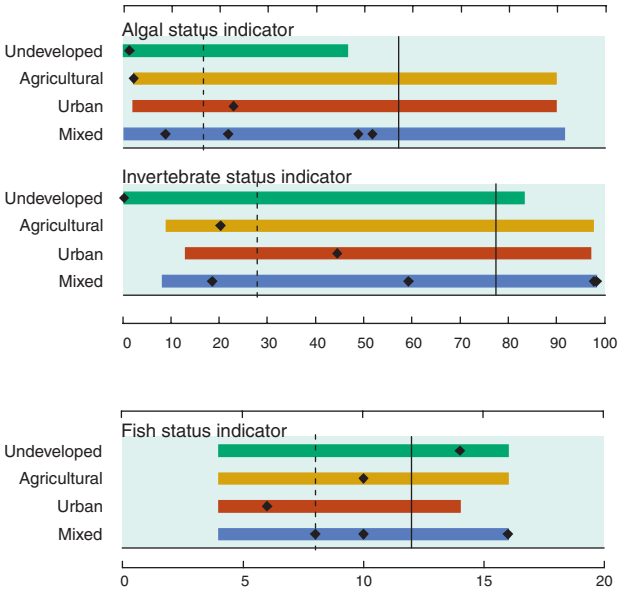
Higher national scores suggest habitat disturbance, water-quality degradation, or naturally harsh conditions. The status of algae, invertebrates (insects, worms, and clams), and fish provides a record of water-quality and stream conditions that water-chemistry indicators may not reveal. **Algal status** focuses on the changes in the percentage of certain algae in response to increasing siltation, and it often correlates with higher nutrient concentrations in some regions. **Invertebrate status** averages 11 metrics that summarize changes in richness, tolerance, trophic conditions, and dominance associated with water-quality degradation. **Fish status** sums the scores of four fish metrics (percent tolerant, omnivorous, non-native individuals, and percent individuals with external anomalies) that increase in association with water-quality degradation

Biological indicator value, Allegheny and Monongahela River Basins, by land use, 1996–98

◆ Biological status assessed at a site

National ranges of biological indicators, in 16 NAWQA Study Units, 1994–98

- Streams in undeveloped areas
- Streams in agricultural areas
- Streams in urban areas
- Streams in mixed-land-use areas
- 75th percentile
- 25th percentile



A COORDINATED EFFORT

Coordination with many agencies and organizations in the Allegheny-Monongahela River Basins Study Unit was integral to the success of this water-quality assessment. We thank those who served as members of our liaison committee.

Federal Agencies

- National Park Service
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Geological Survey
- U.S. Office of Surface Mining , Reclamation and Enforcement

State Agencies

- Maryland Department of Natural Resources
- New York State Department of Environmental Conservation
- New York State Geological Survey
- Pennsylvania Department of Agriculture
- Pennsylvania Topographic & Geologic Survey
- Pennsylvania Department of Environmental Protection
- Pennsylvania Fish & Boat Commission
- West Virginia Department of Environmental Protection
- West Virginia Department of Natural Resources
- West Virginia Geological and Economic Survey

Local Agencies

- Allegheny County Department of Health
- Erie County Department of Public Health and Safety
- Greene County Conservation District
- Seneca Nation Health Department
- Somerset County Conservation District

Universities

- Allegheny College
- California University of Pennsylvania
- Carnegie Mellon University
- Pennsylvania State University
- University of Pittsburgh
- West Virginia University

Other public and private organizations

- Allegheny Watershed Network
- Allegheny County Sanitary Authority
- American Crop Protection Association
- French Creek Project
- Friends of the Cheat
- Jennings Environmental Education Center
- Ohio River Basin Commission
- Ohio River Valley Water Sanitation Commission
- Western Pennsylvania Coalition for Abandoned Mine Reclamation
- Western Pennsylvania Conservancy

We thank the following individuals, agencies, and organizations for contributing to the success of this study

- Property owners throughout the Allegheny and Monongahela River Basins, for granting permission to access their property and to sample their wells.
- Pennsylvania Department of Environmental Protection offices in Ebensburg and Greensburg, Pa., for providing access to mine permits.
- West Virginia Department of Environmental Protection offices in Philippi and Nitro, W.Va., for providing access to mine permits.
- Randy Robinson, for providing white water rafting photographs and rafting guide services on the Cheat River.
- Dick Snyder, Pennsylvania Fish and Boat Commission, for providing access and copies of fish community and survey data.
- Jay Stauffer, Pennsylvania State University and students for assistance with electrofishing.
- Charles Durista, Pennsylvania Department of Environmental Protection, Jay Hawkins, U.S. Office of Surface Mining, and Jen Novak, Allegheny River Alliance, for providing review comments for this report.
- Technical and editorial reviewers in Lemoyne, Pa., Dr. J. Kent Crawford and Bruce Lindsey.
- The Reports Publishing Unit, Kim Otto, James Bubb, and Terriann Preston, in Lemoyne, Pa., for their outstanding efforts in bringing this report to publication.
- Project staff, including seasonal, temporary, student and volunteer staff members of the Pittsburgh office of the U.S. Geological Survey, who assisted in various aspects of this study, including Thomas Noonan, Gregory Wehner, Devon Renock, Erik Eismont, Scott Coulson, Jeffery Weitzel, Greg Hawkins, Jay Hawkins, Craig Uzelac, Douglas Chichester, Adam Locke, Rachel Mowery, Juliane Bowman Brown, and Julie Baldizar.

A COORDINATED EFFORT

Coordination with many agencies and organizations in the Allegheny-Monongahela River Basins Study Unit was integral to the success of this water-quality assessment. We thank those who served as members of our liaison committee.

Federal Agencies

- National Park Service
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Geological Survey
- U.S. Office of Surface Mining , Reclamation and Enforcement

State Agencies

- Maryland Department of Natural Resources
- New York State Department of Environmental Conservation
- New York State Geological Survey
- Pennsylvania Department of Agriculture
- Pennsylvania Topographic & Geologic Survey
- Pennsylvania Department of Environmental Protection
- Pennsylvania Fish & Boat Commission
- West Virginia Department of Environmental Protection
- West Virginia Department of Natural Resources
- West Virginia Geological and Economic Survey

Local Agencies

- Allegheny County Department of Health
- Erie County Department of Public Health and Safety
- Greene County Conservation District
- Seneca Nation Health Department
- Somerset County Conservation District

Universities

- Allegheny College
- California University of Pennsylvania
- Carnegie Mellon University
- Pennsylvania State University
- University of Pittsburgh
- West Virginia University

Other public and private organizations

- Allegheny Watershed Network
- Allegheny County Sanitary Authority
- American Crop Protection Association
- French Creek Project
- Friends of the Cheat
- Jennings Environmental Education Center
- Ohio River Basin Commission
- Ohio River Valley Water Sanitation Commission
- Western Pennsylvania Coalition for Abandoned Mine Reclamation
- Western Pennsylvania Conservancy

We thank the following individuals, agencies, and organizations for contributing to the success of this study

- Property owners throughout the Allegheny and Monongahela River Basins, for granting permission to access their property and to sample their wells.
- Pennsylvania Department of Environmental Protection offices in Ebensburg and Greensburg, Pa., for providing access to mine permits.
- West Virginia Department of Environmental Protection offices in Philippi and Nitro, W.Va., for providing access to mine permits.
- Randy Robinson, for providing white water rafting photographs and rafting guide services on the Cheat River.
- Dick Snyder, Pennsylvania Fish and Boat Commission, for providing access and copies of fish community and survey data.
- Jay Stauffer, Pennsylvania State University and students for assistance with electrofishing.
- Charles Durista, Pennsylvania Department of Environmental Protection, Jay Hawkins, U.S. Office of Surface Mining, and Jen Novak, Allegheny River Alliance, for providing review comments for this report.
- Technical and editorial reviewers in Lemoyne, Pa., Dr. J. Kent Crawford and Bruce Lindsey.
- The Reports Publishing Unit, Kim Otto, James Bubb, and Terriann Preston, in Lemoyne, Pa., for their outstanding efforts in bringing this report to publication.
- Project staff, including seasonal, temporary, student and volunteer staff members of the Pittsburgh office of the U.S. Geological Survey, who assisted in various aspects of this study, including Thomas Noonan, Gregory Wehner, Devon Renock, Erik Eismont, Scott Coulson, Jeffery Weitzel, Greg Hawkins, Jay Hawkins, Craig Uzelac, Douglas Chichester, Adam Locke, Rachel Mowery, Juliane Bowman Brown, and Julie Baldizar.

NAWQA

National Water-Quality Assessment (NAWQA) Program
Allegheny and Monogahela Basins

ISBN 0-607-95411-6

Anderson and others— Water Quality in the Allegheny and Monongahela River Basins
U.S. Geological Survey Circular 1202